

## An Assessment of the Regional and National Socio-Economic Impacts of the 2007 Rift Valley Fever Outbreak in Kenya

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**Abstract.** Although Rift Valley fever (RVF) has significant impacts on human health and livestock production, it can also induce significant (and often overlooked) economic losses among various stakeholders in the marketing chain. This work assesses and quantifies the multi-dimensional socio-economic impacts of the 2007 RVF outbreak in Kenya based on a rapid assessment of livestock value chains in the northeast part of the country and a national macroeconomic analysis. Although study results show negative impacts among producers in terms of food insecurity and reductions in income, we also found significant losses among other downstream actors in the value chain, including livestock traders, slaughterhouses, casual laborers, and butchers, as well as other, non-agricultural sectors. The study highlights the need for greater sensitivity and analyses that address the multitude of economic losses resulting from an animal disease to better inform policy and decision making during animal health emergencies.

### INTRODUCTION

Rift Valley fever (RVF) has had significant impacts on human and animal health alike in East Africa and the Middle East. Past outbreaks in South Africa (1951), Egypt (1977/78), Kenya (1997), and Saudi Arabia (1998–2000) resulted in the cumulative loss of thousands of human lives. The 2000 outbreak in Saudi Arabia led to the imposition of trade bans of live animals from the Horn of Africa (Ethiopia, Somalia, and Kenya) that had devastating economic impacts: one study estimated that total economic value-added in the Somali region of Ethiopia fell by US\$132 million because of these trade bans, a 42% reduction compared with normal years (Nin Pratt A and others, unpublished data). In 2007, RVF returned to East Africa, impacting both Kenya and Tanzania. Specifically hard hit by this latest outbreak were the pastoral communities of the north eastern (NE) part of Kenya. In this region, livestock serve an important livelihood function for pastoralists, with livestock trade representing over 90% of pastoral incomes (Mutunga N and others, unpublished data). Moreover, NE Kenya has the highest incidence of poverty within Kenya, with poverty rates of approximately 70% in 2004 (Society for International Development, unpublished data).

An overlooked component in the socio-economic analysis of animal diseases is the multiplicity of stakeholders that are affected.<sup>1</sup> The RVF does not just affect producers, but also impacts a host of other service providers within the livestock supply chain and other parts of the larger economy. Cumulatively, these downstream impacts can often dwarf the impacts of the disease at the farm level, but public policy tends to concentrate primarily on losses accruing to producers. The failure to capture these diverse impacts may have important implications on the evolution and control of disease that may accentuate its impact.

### METHODS AND MATERIALS

To understand the multifaceted impacts of RVF, two types of approaches were used. First, a value chain analysis was con-

ducted based on the use of semi-structured interviews and following the methods espoused by Kaplinsky<sup>2</sup> and most recently applied in the context of livestock products by Rushton and others (pp. 132–135).<sup>3</sup> This approach (p. 121) conceives of the value chain as “the full range of activities that are required to bring a product or service from conception, through the intermediary phases of production, delivery to final consumers, and final disposal after use.”<sup>2</sup> The emphasis is thus on the linkages and relationships both between and within actors at each stage of production.

Interviews of key value chain stakeholders in the cattle, sheep, and goat sectors were conducted during April–May 2007 by researchers from the International Livestock Research Institute. Interviews were carried out with officials from the Ministry of Livestock and Fisheries and various agents in these livestock production and marketing chains in Garissa and Ijara districts. Our primary data was supplemented with secondary data on livestock production, price movements, poverty rates, and income levels to contextualize the nature of the chain and assess the market impacts of RVF. Table 1 summarizes the types of actors interviewed in our fieldwork. The analysis was necessarily a partial analysis and only focused on convenience sampling of a small subset of chain actors to extrapolate the broader impacts reported in this study. Although more thorough sampling and survey techniques would enhance the scientific rigor of the analysis (and indeed, such sampling protocols remain a research gap in value chain analysis in general), the study nonetheless provides guidance on a multiplicity of impacts not generally examined in animal health research. Moreover, the complexity of value chains themselves inherently places significant limitations on the scope of sampling frames within the chains, particularly for traders and input suppliers.

Second, an assessment of the macro-level impacts of RVF was addressed through the use of the most recently available social accounting matrix (SAM) for Kenya (Kiringai J and others, unpublished data). The SAMs are a type of input-output model in which economy-wide interactions between different economic sectors are modeled in an accounting framework.<sup>4</sup> The Kenya SAM is based on 2003 data and consists of 136 economic sectors. Because of the significant data resources involved in the construction of a SAM and because input-output relationships are relatively stable over time, the use of a 2003 SAM for the analysis of a 2007 event is appropriate and will not adversely influence the simulation results.

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TABLE 1

Types and numbers of respondents (individuals and institutions) interviewed in the red meat value chain by region, April 2007

Market chain	Garissa				
	Ijara	Garissa	Mwingi	Thika	Nairobi
Site	Ijara	Garissa	Mwingi	Thika	Nairobi
Livestock ministry officials	2	2	2	1	
Local leaders	1	1			
Livestock producers	5	4			
Livestock traders	2	2	1		
Livestock traders associations		1			
Livestock transporters		1			
Marking boys in livestock markets		1			
Slaughter house officials		1	1	1	2
Meat wholesalers					1
Butchers	2	1	1	2	1
Hotel operators and other business people	1	1			1
Poultry farmer		1			
Livestock Information Network and Knowledge System (LINKS) Project		1			
Kenya Meat Commission (KMC)		1			

The SAM disaggregates the livestock sector into the production of beef, poultry, sheep and goats, dairy, other livestock, fish, and meat. A SAM analysis traditionally involves the computation of “multipliers” that measure the effects of an arbitrary one-unit demand shock to one sector of the economy on the other economic sectors in the SAM.<sup>5</sup> Given that animal diseases such as RVF involve shocks to both supply (i.e., from livestock mortality) and demand (i.e., from reduced domestic consumption or trade bans by overseas partners), the approach used in this work follows the mixed multiplier approach, which allows the incorporation of both supply and demand shocks in the multiplier matrix.<sup>1,6</sup> Ideally, a computable general equilibrium (CGE) model using the Kenya SAM would be used to examine such second-round impacts,<sup>7</sup> though the construction of a CGE often entails considerable resources and complexity in modeling not available at the time of study.<sup>1</sup> In addition, the marginal return in terms of information gathered from more complex models is often quite small relative to the high marginal costs in terms of resources required. Nonetheless, SAMs still provide important insights on first-round, macroeconomic, and distributional impacts on the relative magnitude of impacts affecting different sectors and income categories to help guide policymakers.

## RESULTS

In this section, we report the diverse sets of impacts extrapolated from the 2007 RVF outbreak in Kenya. We divide these in terms of overall value chain impacts (by actor) and national impacts on the Kenyan economy. As a means of contextualizing the value chain analysis, Figures 1 and 2 illustrate the value chains for livestock (cattle, sheep, and goats) from the two study regions (Garissa and Ijara) based on our fieldwork and highlight the multitude of links and stakeholders from production to final consumption. In our value chain analysis, we focus on four main categories of actors: producers, traders, slaughterhouses, and butchers. At the same time, we pay close attention to other stakeholder impacts associated within these broad categories. A summary of representative impacts by major chain actors is provided in Table 2; specific impacts are elucidated in the relevant sections below.

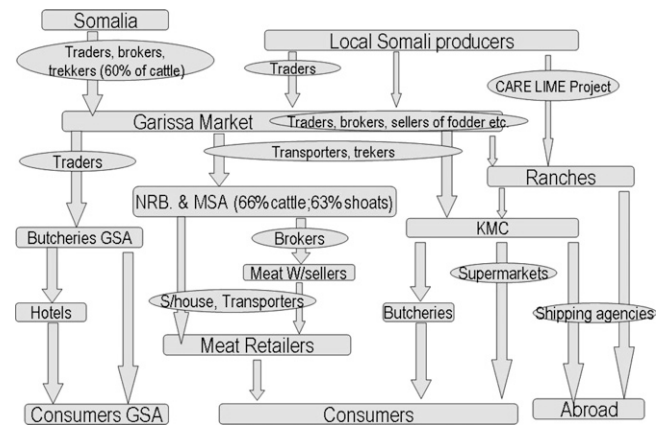


FIGURE 1. Value chain for livestock products originating in Garissa. Source: Compiled from primary fieldwork, April 2007.

**Value chain impacts. Producers.** The RVF outbreak in NE Province occurred when animal prices are at their highest (i.e., during the rainy season when animals are in their best condition). Prices of animals tend to be highest during these months as animals tend to be well nourished and heavy. However, the outbreak prevented the large-scale sale of animals because of quarantines on movement and slaughter. Those that could sell animals reportedly received lower prices (up to 20%) than those prevailing before the outbreak. At the same time, live animal prices in the region reportedly stabilized after the outbreak at levels equal to or higher than those before the outbreak. The higher prices of goats observed after the outbreak was contained and reflected a reduction in supply of these animals caused by animal deaths and abortions during the outbreak.

The main negative effects on producers were caused by the loss of animals that died of RVF, which in turn had impacts on food security and future income (e.g., from the loss of future stock caused by animal abortions). We estimated the total number and value of animals that died as a result of RVF in Garissa and Ijara districts based on disease incidence estimates, mortality rates, and average market prices obtained from field interviews (Table 3). Total economic losses from livestock mortality in these two regions were calculated at over Ksh 610 million (over US\$9.3 million at an exchange

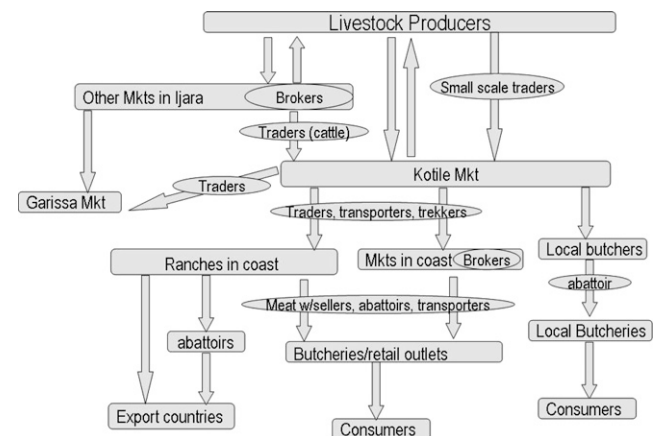


FIGURE 2. Value chain for livestock products originating in Ijara. Source: Compiled from primary fieldwork, April 2007.

TABLE 2

Summary of financial losses made by surveyed actors in the livestock production and marketing chain during the Rift Valley fever (RVF) pandemic for a representative type of agent\*

	Form of loss	Value of loss (Ksh per market agent)
Livestock producers	Dead animals	Up to 175,000
	Lack of milk caused by abortion in camels	Up to 758,800
Livestock traders	Unsold animals that died	Up to 180,000
	Maintenance of unsold animals during quarantine	Up to 21,000
	Losses caused by poor selling prices	Up to 24,000
Slaughterhouses	Closure or reduced number of kill	132,000 to 1,440,000
Butchers	Closure or reduced	Up to 125,000

\* Source: Informant interviews.

rate of US\$1 = Ksh 65). We further quantified the value of losses in both milk and future animal stocks caused by RVF-induced abortions on livestock. The total number of abortions by species was estimated as the product of total abortions, total population by species, proportion of females in herds, the proportion of pregnant female animals at the time of the outbreak, disease incidence, and the abortion rate by species. Assuming that milking animals (both cows and camels) that aborted took an average of 3 months to come back into heat, we estimated in Table 4 that producers in Garissa District lost nearly 2.3 million liters in potential milk production valued at over Ksh 5 million (US\$77,000). It is also important to note that RVF-induced abortions undermined the building up of animal stocks. For instance, as noted in Table 4, we estimated that RVF-induced abortions in sheep caused a 22% reduction in potential flock sizes.

**Value chain impacts. Traders.** Livestock traders were particularly impacted by the movement bans established during the RVF outbreak. Most of the interviewed traders did not sell any animals during the outbreak; in some cases, traders incurred further added costs of maintaining animals they had purchased just before the movement bans began. At the same time, the interviewed traders revealed that they tried to engage in other economic activities to help cope with the losses incurred because of the RVF outbreak, such as running general merchandise shops and kiosks. However, because livestock trading typically represents about 60–80% of trader income, many traders were forced to rely on their savings. Furthermore, because economic activities were depressed during the RVF

outbreak in many communities in NE Kenya, turnover in these alternative trading activities was lower than normal. Combined, this made it difficult for traders to resume their livestock trading activities when the outbreak was contained. Indeed, informant interviews revealed that of the 22 traders in Mwingi that trade in animals from Garissa, 10 had not restarted their operations after the outbreak had been contained. In addition, we found that 50 of the 100 local cattle traders and 150 of the 200 goat traders in Mwingi had not resumed their activities as of April 2007 (1 month after the cessation of the outbreak) because of a lack of financial capital.

Field interviews with livestock traders in NE Province and Mwingi and collected secondary data further highlighted the impact RVF had on demand and prices for animals in end-markets in Nairobi and Mombasa. These price declines in source regions (e.g., Garissa) were caused by a combination of movement bans in supplying regions, whereas declines in prices in end-markets such as Nairobi reflected sharp decreases in consumer demand for meat. At the same time, the magnitude of these price movements varied by species, as indicated by Figures 3 and 4. In the case of goats, there was an initial price spike in Nairobi caused by the imposition of movement bans from NE Kenya. As the outbreak progressed and consumers shifted away from goat meat consumption, goat meat prices fell sharply and recovered slowly once the outbreak was contained (Figure 3). Interestingly, once the outbreak was contained, goat prices in source markets rose quickly to their pre-pandemic levels. This squeezed marketing margins received by traders. In the case of cattle, while prices fell slightly in both Nairobi and Mombasa, they eventually stabilized at a level close to what prevailed before the outbreak (Figure 4).

**Value chain impacts. Slaughterhouses.** The impact of RVF on slaughterhouses varied depending on whether the slaughterhouse was in or outside of a quarantine area. Slaughterhouses in NE Province and Mwingi (inside the quarantine areas) remained closed for up to 3 months until the ban was lifted. In both cases, the closure of slaughterhouses had impacts on a significant number of people who indirectly depend on them for their livelihoods. In Garissa, we estimated that some 100 households involved in tea sales, cart transport of meat, and scrap sales were negatively impacted by the closure of the slaughterhouse. We further estimate that the idling of the Garissa and Mwingi slaughterhouses resulted in economic losses of Ksh 189,600 (US\$2,917) and Ksh 52,800 (US\$812) per month, respectively.

TABLE 3

Projected losses of animals in Garissa and Ijara districts during the 2006–2007 Rift Valley fever (RVF) outbreak\*

		Cattle	Goats	Sheep	Camels	TOTAL
Garissa	Livestock population (no.)	265,633	563,400	287,480	118,800	1,235,313
	Disease incidence (proportion)	0.204	0.4	0.83	0.44	
	Mortality rate (proportion)	0.33	0.49	0.61	0.5	
	Number of dead animals	17,882	110,426	145,551	26,136	299,995
	Average animal price (Ksh)	5,000	1,000	500	7,000	
	Value of dead animals ('000 Ksh)	89,412	110,426	72,776	182,952	455,566
Ijara	Livestock population (no.)	270,529	126,840	154,050		551,419
	Disease incidence (proportion)	0.20	0.40	0.83		
	Mortality rate (proportion)	0.33	0.49	0.61		
	Number of dead animals	18,212	24,861	77,996		121,069
	Average animal price (Ksh)	5,000	1,000	500		
	Value of dead animals ('000 Ksh)	91,060	24,861	38,998		154,919

\* Source: Estimated from field interviews, April 2007.

TABLE 4  
Estimates of potential herd and milk losses in Garissa and Ijara\*

District	Species	Estimated number of abortions	Reduction in potential herd sizes (%)	Projected milk loss ('000 L)	Value of milk lost ('000 Ksh)
Garissa	Cattle	5,207	2	325	4,881
	Camel	5,370	5	1,960	58,805
	Goats	44,708	8		
	Sheep	63,353	22	2,286	
	<b>TOTAL</b>				<b>63,686</b>
Ijara	Cattle	5,303	2	331,428	4,971
	Goats	10,065	8		
	Sheep	33,949	22		

\* Source: Estimated from field interviews, April 2007. In computing the value of milk lost, it was assumed that a liter of camel milk costs Ksh 30 and that of cattle milk costs Ksh 15.

A positive, though possibly short-lived, benefit of the outbreak was an increase in the sale of inspected meat. Before the outbreak, illegal sales of uninspected meat were quite common. During (and after) the outbreak, consumer demand shifted toward meat that had been certified by public meat authorities, which increased demand for formal sector meat. Indeed, many slaughterhouses and butchers prominently displayed their inspection certificates to instill greater consumer confidence in their products. Partially as a result of the increased demand for certified meat, we found that kill rates post-outbreak doubled at the Garissa slaughterhouse (from about 50 shoats daily to 100 after the outbreak).

In downstream markets such as Thika and Nairobi, there was a significant decline in slaughter activities during the outbreak. For instance, the daily kill rate in Thika fell from over 40 head of cattle pre-outbreak to about 15 during the outbreak. Likewise in Nairobi, the daily kill rate for cattle fell from 100 per day to 4 in Dandora and from 75 to 25 in Dagoretti. We estimated that these two slaughterhouses in Nairobi each lost between Ksh 1.1 million to Ksh 1.4 million (approximately US\$17,000–US\$22,000) in direct revenue during the outbreak. Once the outbreak was contained, we found that business had not fully normalized in Dandora, where kill rates remained about one-half of normal levels 1 month after the outbreak.

As in Garissa and Mwingi, casual labor and ancillary service activities (e.g., cart pushers, scrap sales) were adversely

affected by the outbreak. Approximately 60–80% of workers in Nairobi-based slaughterhouses are casual workers, many of whom were idle during the outbreak. The slaughterhouse at Dagoretti in Nairobi, for example, reduced its casual labor force by over 60% during the outbreak. In addition, because many day laborers are paid based on the volumes of meat handled, even those that did work during the outbreak earned significantly less than normal. In the Dandora and Dagoretti slaughterhouses, incomes of day laborers fell from an average of Ksh 290 to 330 (US\$4.50–5.08) per day to just Ksh 50 to 100 (US\$0.75–1.53) per day.

One slaughterhouse that was not negatively impacted by RVF was the publicly run (and recently reopened) Kenyan Meat Commission (KMC). Interestingly, the volume of sales from KMC actually increased during the outbreak. The KMC was able to procure animals from ranches that had been publicly certified as free of RVF. In addition, unlike private slaughterhouses, KMC, as a public entity, was perceived by consumers as selling “safe meat,” which further buttressed its sales.

**Value chain impacts. Butchers.** As with slaughterhouses, butchers were negatively impacted by the fall in consumer demand for meat. The large number of butchers found in study regions suggests that the impact from the RVF outbreak was widespread. In Garissa, we estimated that there are some 170 private butchers, whereas Mwingi contains roughly 20. During the RVF outbreak, virtually all of these butchers (and their employees) were idle, except for a few that tried to sell chicken or vegetables just to keep their business operational. In end-markets such as Thika, sales fell by over 95%, from an average of 70 to 140 kg per day to just 2–5 kg per day. We estimated that an average butcher lost between Ksh 76,000–Ksh 125,000 (US\$1,169–1,923) during the RVF outbreak in Thika.

As with traders, butchers tried to cope with the outbreak by drawing from their accumulated savings. Similar to traders, however, many butchers exhausted their operating capital, which made it difficult to resume operations once the outbreak had been contained. We found that 28% of butchers in Thika could not resume business immediately after the outbreak, while 11% of butchers in Garissa and 10% in Mwingi were in a similar situation.

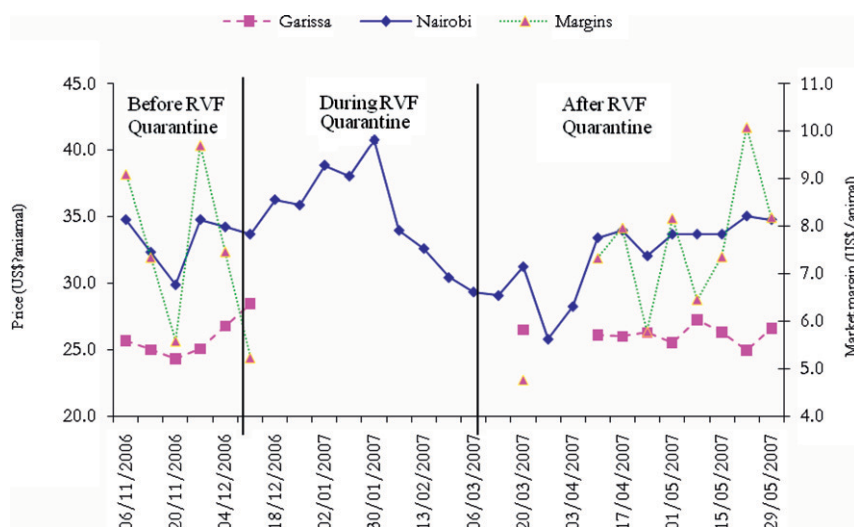


FIGURE 3. Prices of goats in Garissa and Nairobi before, during, and after the Rift Valley fever (RVF) outbreak, 2006–2007. Source: Livestock Information Network and Knowledge System (LINKS) Project.



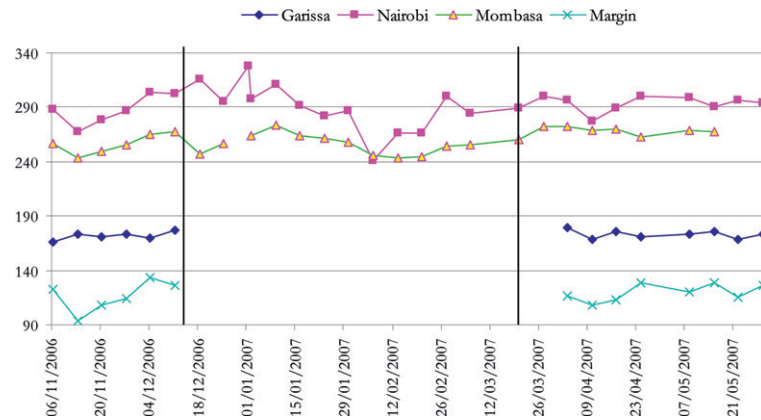


FIGURE 4. Prices of cattle in Garissa and Nairobi before, during, and after the Rift Valley fever (RVF) outbreak, 2006–2007. Source: Livestock Information Network and Knowledge System (LINKS) Project.

**National level impacts.** To examine the impact of an animal disease on the national economy, we conducted a multiplier analysis with the SAM to estimate the changes in the value of national income commensurate with the RVF outbreak.<sup>1</sup> On the basis of marketed offtake rates<sup>8</sup> and the potential number of animals affected by RVF, we estimated that the potential marketed value of cattle declined by 2.3%. We further estimated a 1% decline in the value of dairy and goat/sheep production and a 1% decline in the overall value of meat; the analysis did not examine potential substitution effects of meat caused by a lack of data, although it is probable that non-red meat sectors benefitted in the short run from sharp rises in prices (for instance, survey interviews revealed a doubling in poultry prices during the outbreak).

The results of the simulation are reported in Table 5. We found that as a result of the RVF outbreak, the value of total domestic supply fell by Ksh 2.1 billion (US\$32 million). As one would expect, the bulk of the impacts were felt in the livestock sector. Interestingly, the value of other crops fell by over 0.5%, due in part to lower demand for feed crops. The SAM analysis further highlighted the aggregate losses faced by non-agricultural sectors, notably transportation, trade, chemicals, and petroleum. Shocks to the tourism sector, as proxied by the hotel sector, were relatively small on a percentage basis (less than 0.1%), but valued at Ksh 28 million (over US\$430,000).

Table 6 characterizes the income effects of the simulated RVF outbreak on rural and urban households by income decile as reported in the SAM. In general, income effects were relatively small as a proportion of total annual income (less than 0.15%), though it should be emphasized that this SAM is national and obscures more acute regional impacts. The simulation further highlights that on a percentage basis, the impact of RVF was slightly higher on more well-off households in rural areas, while in urban areas, the impact was more pronounced among middle-decile households. The latter impact could be tied to the loss of employment in livestock-related industries in urban areas (e.g., slaughterhouses, butcheries).

## DISCUSSION

The experience of the 2007 RVF outbreak in Kenya confirmed that the impacts of the disease were not confined to

livestock producers (particularly in the cattle, sheep, and goat sectors) but rather were more widely distributed to a host of diverse downstream actors. In the red meat sector, these effects were quite severe and negative, though substitution effects likely led to sharp (albeit temporary) price rises in pork and poultry products that worked to the benefit of producers in those sectors. At the same time, supply constraints in both the poultry and pork sectors (particularly caused by a lack of breeding stock) and the short-term nature of the outbreak implied that the benefits to these sectors were

TABLE 5

Changes in domestic supply from a simulated shock to selected livestock sectors caused by Rift Valley fever (RVF)\*

Sector	Impact (million Ksh)	% Change
Maize	-21.66	-0.05
Rice	-9.20	-0.10
Oilseeds	-13.61	-0.06
Fruits	-7.35	-0.06
Vegetables	-18.27	-0.06
Other crops	-87.09	-0.54
Beef	-58.36	-0.24
Dairy	-85.14	-0.58
Poultry	-15.35	-0.29
Other livestock	-4.37	-0.15
Sheep and goats	-14.82	-0.33
Fish	-6.14	-0.11
Meat	-107.31	-0.16
Milled grains	-94.49	-0.20
Bakery products	-31.49	-0.09
Beverages and tobacco	-61.66	-0.08
Other manufactured food	-94.48	-0.24
Textiles	-28.02	-0.09
Petroleum	-111.33	-0.07
Chemicals	-126.77	-0.12
Machinery	-92.64	-0.08
Other manufacturing	-68.46	-0.06
Construction	-48.86	-0.03
Trade	-151.24	-0.11
Hotels	-28.20	-0.08
Transportation	-179.15	-0.08
Finance	-109.67	-0.11
Real estate	-66.23	-0.09
Other services	-87.91	-0.06
Other sectors	-255.37	
<b>TOTAL</b>	<b>-2,084.62</b>	<b>-0.09%</b>

\* Source: Model simulations with 2003 Kenya SAM.

TABLE 6

Changes in income from a simulated shock to selected livestock sectors caused by Rift Valley fever (RVF)\*

	Impact (million Ksh)	% Change
<i>Rural areas</i>		
Decile 1 (lowest)	-6.42	-0.06
Decile 2	-14.08	-0.09
Decile 3	-21.73	-0.10
Decile 4	-25.38	-0.09
Decile 5	-32.19	-0.11
Decile 6	-37.71	-0.11
Decile 7	-41.96	-0.11
Decile 8	-52.30	-0.11
Decile 9	-60.10	-0.11
Decile 10	-84.61	-0.11
<b>TOTAL RURAL</b>	<b>-376.48</b>	<b>-0.11</b>
<i>Urban areas</i>		
Decile 1 (lowest)	0.00	-0.09
Decile 2	-0.20	-0.08
Decile 3	-0.55	-0.08
Decile 4	-0.58	-0.13
Decile 5	-2.50	-0.14
Decile 6	-11.92	-0.10
Decile 7	-32.59	-0.09
Decile 8	-50.62	-0.10
Decile 9	-99.61	-0.12
Decile 10	-360.55	-0.11
<b>TOTAL URBAN</b>	<b>-559.12</b>	<b>-0.11%</b>

\* Source: Model simulations with 2003 Kenya SAM.

relatively limited. Many downstream actors were particularly affected by their inability to restart their operations once the outbreak subsided. However, public investment during the outbreak (once it was mobilized) tended to focus on impacts at the producer end (both in terms of animal and human health) and neglected important downstream impacts, many of which had negative impacts at a community level. We would argue that mitigating these downstream impacts associated with an animal disease is an important role in the future for public policy. For instance, the public sector could assist in the provision of short-term, low-interest loans to affected traders, slaughterhouses, and butchers to refinance operations. Such policies would not only dampen the negative impact associated with disease, but also provide incentives for impacted groups to not engage in livestock-related activities that might compromise disease control efforts (e.g., illegal trading during periods of quarantine and animal movement controls).

The private sector also has a role to play in the event of an animal disease outbreak. We found that associations were quite common in the livestock value chain and they could play a potential role in assisting members cope with such crises. The development and administration of "rainy day" funds that members could draw from in periods of crisis, including disease outbreaks, may be one possible function for associations to deal with animal health emergencies. Such funds could be

administered through a small (e.g., Ksh 1/kg) "check-off" fee on sales that accrues to the association for such purposes.

## CONCLUSIONS

The 2007 RVF outbreak in Kenya had wide-ranging impacts on the livestock sector and other segments of the economy that are often overlooked in the analysis of animal disease. These impacts included production impacts, employment losses (particularly for casual labor), and a reduction in operating capital among slaughterhouses and butchers that slowed the recovery of the livestock sector once the disease had abated. On a macroeconomic basis, we estimated that RVF induced losses of over Ksh 2.1 billion (US\$32 million) on the Kenyan economy, based on its negative impacts on agriculture and other sectors (transport, services, etc.) alike.

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